



PROJECT NO. 72

A RESTAURANT RECOMMENDATION SYSTEM FOR INDIVIDUALS AND GROUPS

MR. CHANCHANA WICHA

MS. IRIN YOOKTAJARONG

A PROJECT SUBMITTED IN PARTIAL FULFILLMENT  
OF THE REQUIREMENTS FOR  
THE DEGREE OF BACHELOR OF ENGINEERING (COMPUTER ENGINEERING)  
FACULTY OF ENGINEERING  
KING MONGKUT'S UNIVERSITY OF TECHNOLOGY THONBURI

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2020

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### Abstract

In recent years, recommendation systems are widely used for movies, music, or products in order to reduce the time and effort of the users' searching and increase users' experience. However, restaurant recommendation systems are still very few in this industry and the existing recommenders in Thailand are just randomization applications and the majority of recommender systems are designed for individual users. In contrast, since this activity or event usually occurs in a group of people, not just individually, which each person can have the same or different behaviors, preferences, and interests. Therefore, group decisions often differ from individual decisions. As a result, each decision is often taken longer than one person, and sometimes conclusions are not able to be drawn or it may cause conflicts within the group.

According to the mentioned problems, we were motivated to develop this project, A Restaurant Recommendation System for Individuals and Groups, to better assist in group decision making. Our project is a web application that recommends restaurants in the Bangkok area to users based on their behaviors, preferences, and interests of both individuals and groups eating. The genetic algorithm is applied for generating suitable recommended restaurants for users. Therefore, this project aims to reduce time-wasting of decision making for both individuals and groups and increase the users' experience and satisfaction when using our recommendation system.

**Keywords:** Genetic Algorithm / Optimization Problem / Decision Making Process / Group Recommendation Systems / Web Application / Restaurants

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### บทคัดย่อ

ในช่วงไม่กี่ปีที่ผ่านมาได้มีการใช้ระบบแนะนำ (Recommendation System) อย่างแพร่หลายไม่ว่าจะเป็นภาพยนตร์ เพลง หรือระบบแนะนำผลิตภัณฑ์ต่าง ๆ เพื่อลดระยะเวลาและความยุ่งยากในการค้นหาของผู้ใช้รวมถึงเพิ่มประสบการณ์ของผู้ใช้ อย่างไรก็ตามระบบแนะนำร้านอาหารยังมีน้อยมากในวงการระบบคำแนะนำนอกจากนั้นระบบแนะนำร้านอาหารที่มีอยู่ในประเทศไทยเป็นเพียงแอปพลิเคชันแบบสุมและส่วนใหญ่ออกแบบมาสำหรับผู้ใช้แต่ละรายเท่านั้น ซึ่งในความเป็นจริงแล้วการรับประทานอาหารมักเกิดขึ้นเป็นกลุ่มตั้งแต่ 2 คนขึ้นไปไม่ได้เป็นรายบุคคลเพียงอย่างเดียว ซึ่งแต่ละคนในกลุ่มนั้นมีพฤติกรรม ความชอบและความสนใจที่อาจจะเหมือนหรือแตกต่างกันดังนั้นการตัดสินใจของกลุ่มมักแตกต่างจากการตัดสินใจของแต่ละบุคคล ด้วยเหตุนี้การตัดสินใจในแต่ละครั้ง มักใช้เวลานานกว่าการตัดสินใจด้วยคน ๆ เดียว และในบางครั้งการตัดสินใจนั้นอาจจะไม่สามารถหาข้อสรุปได้ หรืออาจทำให้เกิดความขัดแย้งขึ้นภายในกลุ่ม

ด้วยเหตุนี้เอง ทางผู้พัฒนาจึงมีความตั้งใจที่จะพัฒนาเว็บแอปพลิเคชันสำหรับแนะนำร้านอาหารที่อยู่ในพื้นที่จังหวัดกรุงเทพมหานครสำหรับรายบุคคลและรายกลุ่มขึ้น เพื่อเป็นตัวช่วยในการตัดสินใจทั้งแบบเดี่ยวและกลุ่มได้ดีมากยิ่งขึ้น โดยระบบแนะนำร้านอาหารจะอ้างอิงจากข้อมูลของผู้ใช้งาน ไม่ว่าจะเป็นพฤติกรรม ความสนใจ หรือความชอบ ทั้งแบบเดี่ยวและกลุ่ม ด้วยขั้นตอนวิธีเชิงพันธุกรรม (Genetic Algorithm) ในการหาค่าเหมาะสมที่สุดเชิงคณิตศาสตร์ (Mathematical Optimization) สุดท้ายนี้ผู้พัฒนามีความมุ่งหวังว่าระบบแนะนำร้านอาหารรายบุคคลและรายกลุ่มในโครงการนี้จะช่วยลดเวลาที่ใช้ไปในการตัดสินใจและเพิ่มความพึงพอใจของผู้ใช้งานต่อร้านอาหารที่ระบบได้ทำการแนะนำ

**คำสำคัญ:** ขั้นตอนวิธีเชิงพันธุกรรม / การหาค่าเหมาะสมที่สุดเชิงคณิตศาสตร์ / กระบวนการตัดสินใจ / ระบบแนะนำรายกลุ่ม / เว็บแอปพลิเคชัน / ร้านอาหาร

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## LIST OF SYMBOLS

SYMBOL		UNIT
$\alpha$	Test variable	$m^2$
$\lambda$	Interarrival rate	jobs/ second
$\mu$	Service rate	jobs/ second

**LIST OF TECHNICAL VOCABULARY AND ABBREVIATIONS**

ABC	=	Adaptive Bandwidth Control
MANET	=	Mobile Ad Hoc Network

## **CHAPTER 1 INTRODUCTION**

### **1.1 Keywords**

Genetic Algorithm, Optimization Problem, Decision Making Process, Group Recommendation Systems, Web Application, Restaurants

### **1.2 Problem Statement, Motivation, and Potential Benefits**

“Kin-Rai-Dee? (Where are we going to eat?)” is the most common phrase we ask ourselves and others almost every day. We also believe that many people will as well ask this simple question regularly around mealtimes whether they are going to eat alone or with their group. To decide what and where to eat can take more time than necessary which can lead to frustration and sometimes, in the end, the decision cannot be made.

From the problems online survey, it revealed that 62% of the respondents, 93 out of 148, felt restaurant selection in each meal is their main problem which up to 65.5 % faced the pain about restaurant selection in a group by occurring frequently in a group of friends. The major issue comes from a variety of factors and conditions which lead to the inability to decide. From further inquiries about how they solved the problem, we found that very few people will find a restaurant that matches the conditions of their group. They usually select the restaurant according to the majority which cannot serve everyone’s satisfaction. Some of them use the recommendation application to be their alternative way to decide. Moreover, in the worst case, they just eat separately.

Even though various applications can suggest food to users, almost all of them just randomize the suggestions without any logic. Moreover, many of them suggest only food, not a restaurant. Based on our research, some applications that can suggest a restaurant based on their users’ preference still cannot support a suggestion for a group.

In this project, we will implement a web application that can solve the mentioned problems and improve the existing solutions. Our application will recommend a restaurant based on individual or group preferences, behaviors, and customizations. We hope that the application will be able to reduce time-wasting in choosing restaurants and give us no more frustration.

### **1.3 Project Type**

Potential Commercial Product

### **1.4 Proposed Method**

#### **1.4.1 Approach**

From the problem statement above, we will develop a web application that suggests a restaurant that matches customer profiles. We will provide a diversity of restaurants in Bangkok from an external source and their gen-

eral information that facilitate their restaurant consideration. Also, we will suggest a restaurant that matches multiple preferences (multiple users) by multi-objective optimization algorithms.

#### **1.4.1.1 Literature Review and Survey**

Explore existing works and knowledge related to our project e.g. recommendation system, multi-objective optimization algorithms, machine learning model, software engineering for web application development, etc. Moreover, we survey and construct a customer journey.

#### **1.4.1.2 Data Collection**

Gather a restaurant profile from an external source which is the restaurant's Facebook pages. and user profile from our data collection tool.

#### **1.4.1.3 Data Preparation**

A preprocessing method includes cleaning, selecting, normalizing, transforming, etc. to be a training set.

#### **1.4.1.4 Construct the Model**

Design and construct a model and train with prepared data, model evaluation, and hyperparameter tuning. This model will be integrated with our backend service.

#### **1.4.1.5 Design User Interface**

Design an user interface for our web application. This design process includes prototype implementation and prototype testing which can improve the user experience.

#### **1.4.1.6 Build a Web Application**

Implement a web application from our design. This implementation includes frontend and backend development.

#### **1.4.1.7 Validation**

Validate our completed web application which integrated our model. This process includes feedback gathering from users, feedback evaluation, model performance evaluation, and application performance monitoring.

### **1.4.2 Objectives**

- To collect and analyze the customer behavioral data.
- To implement an analytical model that can suggest the right restaurant to individuals or a group of people based on their preferences, profiles, and behaviors.

- To implement a web application that allows users and groups of users to input their preferences and obtain the recommended restaurants.
- To reduce time-wasting on a restaurant consideration.

### **1.4.3 Scope**

- Our web application supports modern web browsers such as Google Chrome, Safari, Firefox.
- Our web application focuses on the person or group of people who eat in the restaurant (not focus on delivery).
- Internet access is required in order to use our application.
- Restaurants in our database obtained from an external source are only restaurants in Bangkok.

## **1.5 Original Engineering Content**

In this project, we will develop the following software, dataset, and algorithm:

### **1.5.1 Web Application**

A web application for users that suggests the right restaurant to the right people based on individual preferences and group preferences. This application also collects customer behavior data as well as feedback from users.

### **1.5.2 Customer Behavior Dataset**

Customer behavior data will be collected throughout semesters by both our data collection tool which will be used before our final product and our web application. The data include the restaurant that users choose to go with time series and their demographic information.

### **1.5.3 Group Recommendation Algorithm**

Our system will recommend restaurants to individuals or groups by using our recommendation algorithm which includes machine learning and multi-objective optimization algorithms.

## **1.6 Task Breakdown and Draft Schedule**

### **1.6.1 Semester 1**

1. Requirement Gathering
  - 1.1. Kick-off meeting
  - 1.2. Brainstorm and analysis
  - 1.3. Survey

- 1.3..1. Competitor survey
  - 1.3..2. Paper survey
  - 1.3..3. Target user survey
  - 1.3..4. Market survey
- 1.4. Survey conclusion
- 1.5. Requirement conclusion
- 2. Create Proposal
- 3. Researching
  - 3.1. Recommendation algorithm researching
  - 3.2. Optimization algorithm researching
- 4. Midterm Project Presentation (Slide and video presentation)
- 5. Data Collection Phase I
  - 5.1. Restaurant profile collection from sources
  - 5.2. Implement user data gathering tool
  - 5.3. User profile collection from tool
- 6. Design
  - 6.1. UX/UI Design
    - 6.1..1. Customer journey
    - 6.1..2. Create wireframe
    - 6.1..3. Test wireframe
    - 6.1..4. UI design
    - 6.1..5. Prototype implementation
    - 6.1..6. Test prototype
    - 6.1..7. Improvement
  - 6.2. Architecture Design
    - 6.2..1. System architecture
    - 6.2..2. Database
- 7. Create Final Report
- 8. Final Project Presentation (Slide and video presentation)

## **1.6.2 Semester 2**

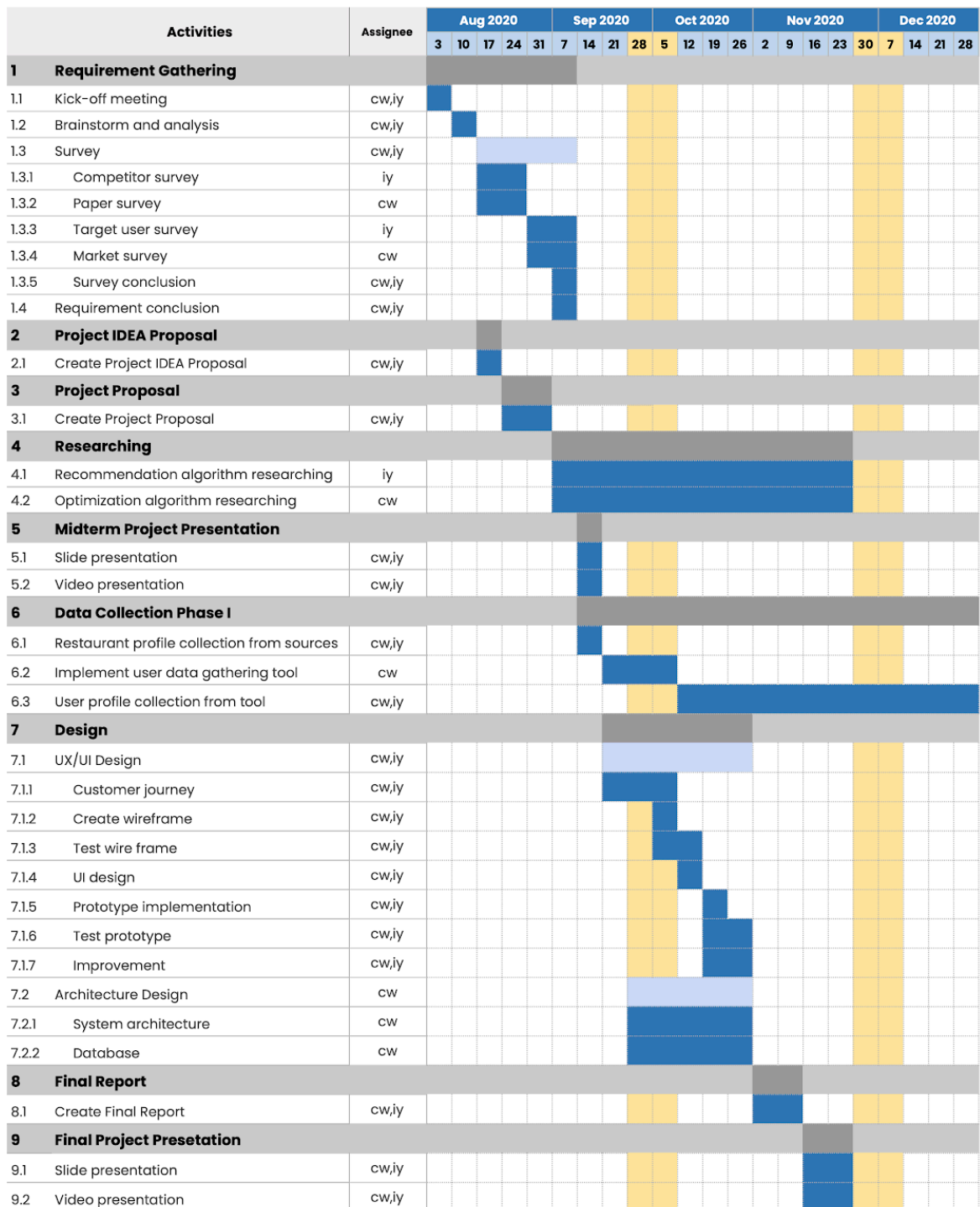
- 1. Development
  - 1.1. Application Development
    - 1.1..1. Web application implementation
    - 1.1..2. Testing



- 1.1..3. Application improvement
- 1.2. Model Development
  - 1.2..1. Model construction and training
  - 1.2..2. Model evaluation
  - 1.2..3. Model improvement
- 1.3. Integration Testing
  - 1.3..1. Testing
  - 1.3..2. Debugging
- 1.4. User Acceptance Testing
  - 1.4..1. User testing
  - 1.4..2. User feedback gathering
  - 1.4..3. Feedback evaluation
  - 1.4..4. System improvement
- 1.5. Create Report and Presentation
- 1.6. Production Deployment
  - 1.6..1. Backend deployment
  - 1.6..2. Frontend deployment
  - 1.6..3. Production testing

# Semester 1 Gantt Chart

Web Application that Suggests the Right Restaurant to the Right People.

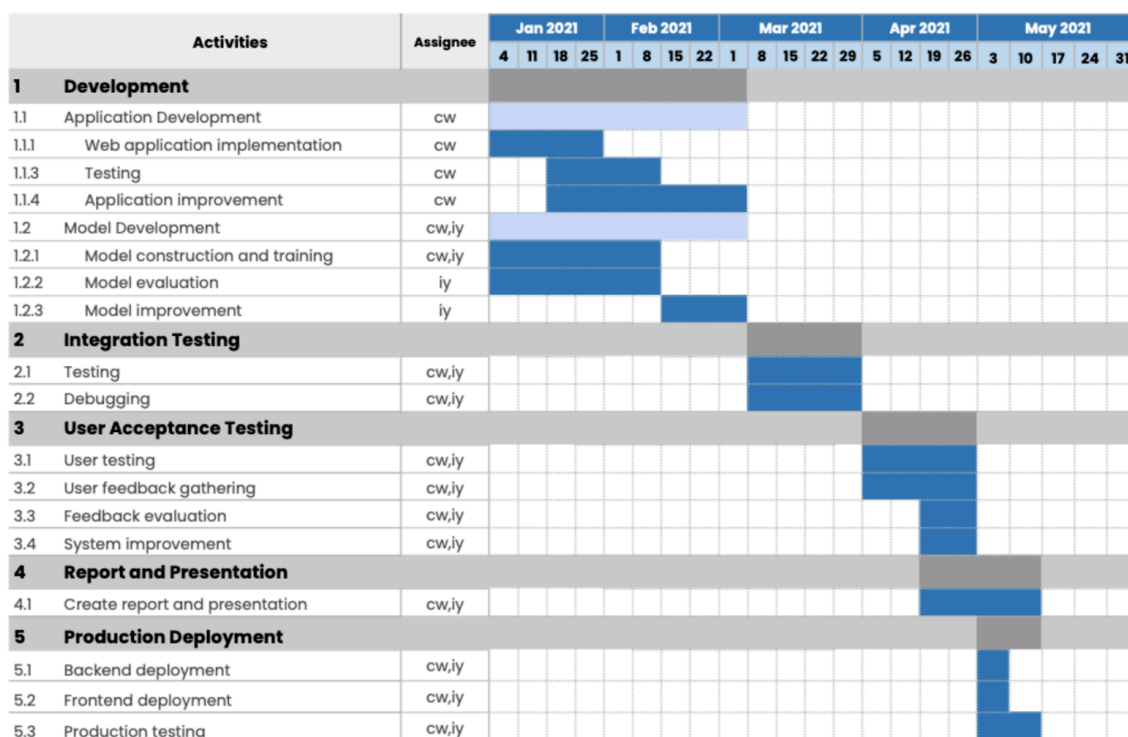


cw = Chanchana Wicha iy = Irin Yooktajarong

Figure 1.1 Gantt Chart for the First Semester

## Semester 2 Gantt Chart

Web Application that Suggests the Right Restaurant to the Right People.



cw = Chanchana Wicha iy = Irin Yooktajarong

Figure 1.2 Gantt Chart for the Second Semester

### 1.7 Deliverables for Term 1

- Requirement Specification
- Survey Result
- Data Collection Tool
- Dataset (Customer Behavior and Restaurant Information)
- Customer Journey
- Prototype (Web Application)
- Database Schema
- System Architecture and Class Diagram
- Suggestion Algorithm and Model

### 1.8 Deliverables for Term 2

- Web Application (Frontend and Backend)

- Recommendation System both Individuals and Groups
- Feedback from Users
- Application Performance Evaluation
- Model Performance Evaluation